End-to-end QoS management issues over DiffServ networks

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Recent times the performance of the personal computers increases likewise the number of real-time Internet and multimedia applications. In the case of such applications *best effort* treatment of the Internet traffic is not enough for satisfying the quality demand of end users. However, *best effort* is the only service approach on the Internet today. The network elements try their best to deliver the packets to their destinations without any hard bounds on end-to-end delay, jitter, and latency. These "guarantees" are not sufficient for i.e., a videoconference, because high delay or jitter can cut down or ruin the interactivity and usability.

The goal of the Internet Service Providers (ISPs) is to satisfy the quality demand of customers and to ensure the same sort of QoS and reliability over IP networks as in the circuit switched networks. By applying packet classification they can deliver different kind of services on the same link without downgrading the quality of the important flows. One of the possible solutions is the Differentiated Services architecture.

DiffServ [1] is a model that allows deployment of QoS in a simple fashion using network devices only handling traffic at an aggregate level rather than per flow. DiffServ defines the DS (DiffServ) domain, which is a contiguous set of DiffServ capable nodes. Obviously, without accurate domain management, the concept does not work effectively. A proper domain manager is able to use the resources of the domain more effectively, and makes it possible to satisfy the customer's claims. The domain manager of the DiffServ model is called Bandwidth Broker as introduced in RFC 2638 [2].

The BB is aware of the topology of the domain and has correct information on the currently reserved and free link capacities. The main functions of the BB can be grouped into two groups. The intra-domain functionality covers managing the resources of the own domain. Another group of the BB functions is the inter-domain communication extension, which includes exchange of information on the available services between the Bandwidth Brokers of the adjacent domains, and the negotiation based on the received availability information.

In the last three years several inter-domain protocols has been developed such as BGRP[3], SIBBS[4], RNAP[5] etc. These methods are independent from the routing used in the network and focus mainly on the correct administration of inter-domain reservations. Although there are several solutions for QoS routing, the Internet still uses static routing as well. Since the efficiency of these protocols highly depends on the routing algorithm applied in the network, they may produce low resource utilization among static routing environment.

Our work presents an inter-domain communication protocol, which works in a Bandwidth Broker environment. We use a BB, which support dynamic intra-domain routing. This means that the intra-domain side of the BB is able to change the routing per flow, if the inter-domain part asks it to. We separate two types of routing in this way. The intra-domain routing, which is the part of the intra-domain management, and inter-domain routing as the part of the inter-domain communication. Using our own inter-domain routing method the BB can calculate several alternative routes to the destination domains, and produce higher resource utilization and greater successful reservation ratio.

This protocol defines availability messages for all the available sink domains. An availability message consist of, the name of the sink domain, the available bandwidth, hop number and other parameters. The appropriate propagation of these messages makes it possible to calculate the next hop domain for each sink domain. This propagation works over domains like a distributed QoS routing [6] over routers. We also define a reservation protocol between Bandwidth Brokers, which uses the calculated next hop domains to determine the path of the

reservation. The presentation will give an overview of the simulation of this inter-domain communication method and will introduce the measured results.

References

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